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| 09/967,081 | 09/28/2001 | Hong Hie Lee | DE-1302 | 6636 |

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EXAMINER

CULBERT, ROBERTS P

| ART UNIT | PAPER NUMBER |
|----------|--------------|
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1763

DATE MAILED: 03/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

AC

Office Action Summary

Application No.

09/967,081

Applicant(s)

LEE ET AL.

Examiner

Roberts Culbert

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 February 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

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DETAILED ACTION

Response to Arguments

Applicant's arguments filed 2/9/04 have been fully considered but they are not persuasive.

Applicant has argued that.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies are not recited in the rejected claim(s).

"In Nealey et al, the material to be patterned (or molded) has to be a fluid ... In contrast, in the present invention, the material can be a solid or fluid to work..."

"...in Nealey et al, capillarity is utilized to make a fluid locally placed outside of a mold to be sucked (horizontally) into the inside of the mold. However, in the present invention, capillarity is utilized to cause capillary rise (vertical) within and inside the mold over the whole area."

"Nealey et al. and Kim et al. is a limited patterning method that is applicable only to those patterns in which all the void space has to be open-ended and more importantly all interconnected"

Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Applicant has argued:

"Further, in Kim. et al, a solvent that dissolves the photoresist, instead of a prepolymer fluid, is placed at one ends of open channels made by contacting the mold 20 with the thin layer 124 of chromium (See col.26, lines 23-31 of Kim et al.). That is, when the solvent is sucked into the channels it dissolves the photoresist present at the bottom of the channels and the dissolved photoresist in fluid form is removed through the other ends of the channels, which is clearly different from the present invention of

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claims 3 and 14, wherein a fluidizing material is permeated into the polymer material deposited on the substrate or the thin film layer before the mold is rendered to be in contact with the polymer material, the purpose of which is to make the polymer material mobile to be collected into the recessed portion of the mold."

The argument is not persuasive because Kim et al. teaches permeating a fluidizing material (solvent) into the polymer material (photoresist) in order to provide fluidity to the polymer material before in contact with the mold with the polymer material as claimed.

Applicant's arguments amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1 and 4 are rejected under 35 U.S.C. 102(b) as being anticipated by the publication to Nealey et al.

Referring to Figure 11.13, Nealey teaches a method for forming a micro-pattern on substrate by employing a mold having a predetermined pattern structure, the method comprising steps of: preparing a

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mold having a predetermined pattern structure containing a recessed portion and a protruded portion; depositing a polymer material on the substrate; rendering the protruded portion the mold to be in contact the polymer material; incorporating the polymer material in contact with the protruded portion of the mold into an empty space of the recessed portion thereof by using capillary force thereof, thereby removing the polymer material in contact with protruded portion the mold; and exposing a portion of the top surface of the substrate by detaching the mold to thereby form a polymer micro-pattern the substrate.

Regarding Claim 4, the mold is made from a polymer (PDMS).

Claims 1, 3, 4, 6, 12, 14, 15, 17, and 19 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent 6,355,198 to Kim et al.

Referring to Figure 1, Kim teaches a method for forming a micro-pattern (38) on substrate (30) by employing a mold (20) having a predetermined pattern structure, the method comprising steps of: preparing a mold having a predetermined pattern structure containing a recessed portion (24) and a protruded portion (22); depositing a polymer material (36) on the substrate; rendering the protruded portion the mold to be in contact the polymer material; incorporating the polymer material in contact with the protruded portion of the mold into an empty space of the recessed portion thereof by using capillary force thereof, thereby removing the polymer material in contact with protruded portion the mold; and exposing a portion of the top surface of the substrate by detaching the mold to thereby form a polymer micro-pattern the substrate.

Referring to Figures 1 and 10a, Kim further teaches a method of forming a micro-pattern on a substrate by employing a mold having a predetermined pattern structure, the method comprising the steps of: preparing a mold having predetermined pattern structure containing recessed portion and a protruded portion; depositing a thin film layer (124) on the substrate (126); forming a polymer material (122) on the overall surface of the thin film layer; rendering the protruded portion the mold to be in contact with the polymer material; incorporating polymer material in contact with the an empty space of the recessed portion thereof by using capillary force thereof to remove the polymer material in contact with the protruded portion of the mold thereby forming a polymer pattern of predetermined shape; etching

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the thin film layer by employing the polymer pattern as a mask thereby selectively remove a portion of the thin film layer; and removing the polymer pattern to thereby form a desired thin film micro-pattern.

** Note that Figure 1 teaches application of the capillary process to a substrate (general process) as in claim 1, but figure 10a shows the application of the process to a thin film formed on a substrate as in claim 12. For details see (Col. 25, Line 65-Col. 26 Line 31).*

Regarding Claims 4 and 15, the mold is made from a polymer (PDMS).

Regarding Claims 3 and 6, Kim teaches that after the step of depositing a thin film layer on the substrate but before the step of rendering the protruded portion the mold to be in contact the polymer material as recited in Claim 1, permeating a fluidizing material into the polymer material in order to provide fluidity to the polymer material (Col. 26, Lines 25-31). Kim further teaches that the polymer material (photoresist) is applied by spin coating (Col. 26, Lines 23-25).

Regarding Claims 14 and 17, Kim does not explicitly teach that the step of permeating a fluidizing material into the polymer material in order to provide fluidity to the polymer material after the step of forming a polymer material on the overall surface of the thin film layer but before the step of rendering the protruded portion the mold to be in contact with the polymer material, as recited in claim 12. However, it is considered an inherent teaching of the reference, as Kim teaches application of the photoresist to both a substrate (Fig 1) and a thin film (Fig 10a) in a capillary micromolding process.

Regarding Claim 19, Kim teaches that the substrate may be made of glass (Col. 25, Line 67), silicon (Col. 26, Lines 23-25) or of any other suitable substrate material (Col. 21, Lines 9-11).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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Claims 2, 7-11, 13, 18, and 20-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,355,198 to Kim.

Regarding Claims 2 and 13, as applied above, Kim teaches the method of the invention substantially as claimed, but does not teach performing a heat treatment to the polymer material between the steps of depositing the polymer on the substrate or thin film, and contacting the polymer with the mold.

However, Official Notice is taken of the fact that the direct relationship between the viscosity of a polymer and the temperature of the polymer is well known in the art of molding polymers. Since capillary flow depends on the viscosity of the polymer, it would have been obvious to one of ordinary skill in the art at the time of invention to perform a heat treatment to the polymer material between the steps of depositing the polymer on the substrate or thin film, and contacting the polymer with the mold.

On of ordinary skill in the art would have been motivated at the time of invention to perform a heat treatment to the polymer material between the steps of depositing the polymer on the substrate or thin film, and contacting the polymer with the mold since doing so would enable the polymer to be drawn into the mold by capillary action.

Regarding claims 20 and 23, Kim teaches that part of the polymer material may be incorporated into the empty space of the mold thereby rendering a remaining part of the polymer material. See Figure 8 for example. Kim teaches that the remaining part is removed (Col. 25, Lines 1-3). It would have been obvious to one of ordinary skill in the art to remove the remaining polymer material by etching since it is entirely conventional in the art to remove polymers from a substrate by etching.

Regarding Claims 7 and 10, as applied above, Kim teaches the method of the invention substantially as claimed, but does not teach depositing a thin film layer on an exposed portion of the top of the substrate and removing the polymer micro-pattern to thereby form a desired thin film micro-pattern. Official Notice is taken that it is notoriously old in the art of forming wiring patterns on a substrate to form a patterned photoresist on a substrate, deposit a thin film metallic layer on the exposed portions of the substrate, and remove the photoresist. Since the method of Kim forms a photoresist pattern on a

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substrate, it would have been obvious to one of ordinary skill in the art at the time of invention to use the photoresist patterning method of Kim to form a wiring pattern in the well-known manner.

Regarding Claims 8 and 21, as applied above, Kim teaches the method of the invention substantially as claimed, but does not teach heating the fluidizing material.

Official Notice is taken that it is well known in the art of forming photoresists to soften or swell a resist using evaporated solvent vapor. It would have been obvious to one of ordinary skill in the art at the time of invention to soften the resist using a solvent vapor formed by heating in order to provide fluidity to the resist in the conventional manner.

Regarding Claims 9 and 18, as applied above, Kim teaches the method of the invention substantially as claimed, but does not teach removal of the polymer with a solvent.

Official notice is taken of the fact that it is common to remove a photoresist with a solvent after patterning. It would have been obvious to one of ordinary skill in the art at the time of invention to remove the photoresist with a solvent in the well-known manner.

Regarding Claims 11 and 22, as applied above, Kim teaches the method of the invention substantially as claimed, but does not teach the use of a novolac resin as the polymer material or PGMEA as the fluidizing material.

Official Notice is taken that it is old in the art of forming photoresist layers to use a resist made from novolac resin and PGMEA solvent. It would have been obvious to one of ordinary skill in the art to use the conventional resist materials as the invention of Kim uses capillary molding to form resist masks and the like.

Claims 5, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,355,198 to Kim et al in view of U.S. Patent 5,772,905 to Chou.

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As applied above, Kim teaches the method of the invention substantially as claimed, but does not teach the use of an inorganic mold.

Chou teaches that an inorganic mold made of SiO_2 is suitable for molding polymers. See (Col. 4, lines 60-63). It would have been obvious to one of ordinary skill in the art at the time of invention to use an inorganic mold material as shown in Chou for molding in the method of Kim, since doing so would allow good release properties for some polymer materials as taught by Chou.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Roberts Culbert whose telephone number is (571) 272-1433. The examiner can normally be reached on Monday-Friday (7:30-4:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory Mills can be reached on (571) 272-1439. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

R. Culbert

R. Culbert

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primary Examiner
AV 1763